

March 2010

Bachelor of Arts in Middle Level Mathematics and Science Teaching Central Washington University

Introduction

Beginning in spring 2010, Central Washington University (CWU) proposes to offer a Bachelor of Arts in Middle Level Mathematics and Science Teaching degree for students preparing to teach 4th through 9th grade math and science. The proposed program would initially enroll 10 FTE students, growing to full enrollment of 30 FTE in its fifth year. At full enrollment, it would produce 15 graduates per year, who would receive CWU's recommendation for a Residency Teaching Certificate with Middle Level Mathematics and Middle Level Science endorsements.

To obtain the degree, students must complete CWU's 47- to 52-credit Professional Education Program (PEP) plus the 74-credit Middle Level Mathematics and Science Teaching (MLMST) major.¹ CWU does not propose to change the PEP, which is a well-established professional preparation component that has operated for years. Instead, CWU seeks Higher Education Coordinating Board (HECB) approval to offer the MLMST major to complement 22 other majors delivered by various departments across the university in subject areas taught in K-12 schools. The proposed program would complement rather than replace middle-level mathematics and science minors currently offered by CWU. Each of these minors provides the coursework necessary for an endorsement.

Relationship to Institutional Role and Mission and the Strategic Master Plan for Higher Education in Washington

CWU has a long history of offering teacher preparation programs² and a mission "to prepare students for responsible citizenship, responsible stewardship of the earth, and enlightened and productive lives."³ The proposed program would support this mission by helping students gain mathematics and science knowledge and skills that will equip them to be informed citizens and

¹ CWU's Teacher Preparation Program (TPP) is accredited by the National Council for Accreditation of Teacher Education (NCATE) and involves two components: the Professional Education Program (PEP) and a major, such as MLMST. Although the PEP is housed in the College of Education and Professional Studies, the MLMST major would be housed in the College of the Sciences, which would be the degree granting unit.

² CWU began operating in 1891 as the Washington State Normal School, which focused on educating elementary and junior high school teachers.

³ Central Washington University, *Office of the President: University Mission, Vision and Values*, available at <http://www.cwu.edu/~pres/mission.html>.

environmental stewards who lead productive lives as teachers. By preparing educators for the 21st century, it would support the *Strategic Master Plan for Higher Education*. Through its focus on middle school mathematics and science, it would expand opportunities for postsecondary degree completion in an area that the Master Plan specifically identifies as an area of need.⁴

Diversity

To ensure diversity within the proposed program, the Center for Teaching and Learning⁵ and College of the Sciences would do the following:

- Inform groups such as the Washington Association for Bilingual Education, tribal agencies, guidance counselors, Gear Up programs, and the College Assistance Migrant Program (CAMP) about the MLMST major and scholarship opportunities;
- Maintain organized contact with all campus cultural and ethnic student organizations to communicate about recruitment efforts and to solicit ideas and help;
- Ensure that the program's marketing materials are designed to attract diverse applicants;
- Recruit students through College of the Sciences' Science Talent Expansion Program (STEP), which targets underrepresented groups, including Hispanics and Native Americans;
- Undertake a minority alumni recruitment initiative;
- Continually monitor the program's culture of appreciation and respect toward diversity and strive to improve the culture.

Program Need

The joint report, *A Skilled and Educated Workforce* (2009),⁶ indicates a continuing and possibly increasing need for mathematics and science teachers, as current shortages are exacerbated by federal teacher qualification rules and changes in high school graduation requirements. The joint report cites a Professional Educator Standards Board (PESB) estimate that hundreds of additional mathematics teachers would be needed to implement the new graduation requirement of three years of mathematics in the state's public high schools. In a separate study conducted by the Office of the Superintendent of Public Instruction (OSPI), every Educational Service District region reported "considerable" or "some" shortage of candidates in mathematics and all science areas.⁷

⁴ Page 19 of the *Strategic Master Plan for Higher Education* states: "In elementary and middle schools especially, many teachers feel unprepared to help students achieve the higher levels of skill in math and science they will need. These teachers need help."

⁵ The Center for Teaching and Learning provides oversight for all CWU teacher preparation programs.

⁶ An employer needs assessment report prepared jointly by the Higher Education Coordinating Board, the State Board for Technical and Community Colleges, and the Workforce Training and Education Coordinating Board.

⁷ Office of Superintendent of Public Instruction (2007). *Educator Supply and Demand in Washington State*. Olympia, Washington.

In addition to responding to employer need indicated by the reports cited above, the program would respond to student need by providing an efficient way to obtain Middle Level Mathematics and Middle Level Science endorsements, reducing time to graduation. For example, a student majoring in MLMST could save up to 39 credits compared to a student majoring in elementary education who is also pursuing both endorsements. Program planners estimate most of the initial enrollment in the MLMST major would result from students shifting to MLMST from elementary education, secondary mathematics, and secondary science. After the first year, enrollments would come from new students, rather than students switching from existing majors.

As evidence for student need, program planners cite student inquiries and survey results. Five students have formally petitioned for the program. Fifty-two students inquired about middle-level mathematics and science and mathematics programs during winter quarter 2008. When CWU surveyed more than 300 students in middle level mathematics and science feeder courses (winter and spring 2008), 39 percent said they were interested in information on the proposed major and 18 percent said they were interested in applying for it.

In addition to responding to employer and student need, the proposed program would respond to community need by strengthening teacher preparation in math and science. For example, giving teacher candidates knowledge and skills to employ hands-on and inquiry methods would implement the Washington Learns strategy of building expertise in math and science teaching. Furthermore, it would do so in a way consistent with the third Washington Learns principle for change, which is to bring creativity into the classroom.

Although various institutions offer programs with coursework necessary for obtaining Middle Level Mathematics and Middle Level Science endorsements, no other public or private institution in the region offers an undergraduate major that results in both. Thus, the proposed program would meet employer, student, and community needs without duplicating existing programs.

Program Description

The proposed program aims to prepare teachers to teach mathematics and science at the middle level (grades 4 through 9). Its target audience would include lower-division CWU students and transfer students. It would be delivered on site in Ellensburg, primarily by face-to-face instruction. It would also include field experiences at various partner schools.

Students would have declared a MLMST major after they were admitted to the Teacher Preparation Program (TPP) and demonstrated mathematics competency equivalent to the completion of MATH 154 (Pre-Calculus Mathematics II). For full⁸ admission to the TPP, students would be required to have:

⁸ Students who do not have the required grade point average or do not pass portions of the WEST-B test may apply for provisional admission.

- Completed at least 45 credits of college-level coursework with a grade point average of 3.0 or higher;
- Completed a dispositional survey and character and fitness supplement;
- Achieved passing scores on the Washington Educator Skills Test-Basic (WEST-B) and two scored recommendation forms;
- Achieved a “C” or higher grade in one math and two English prerequisite courses, completed a bachelor’s degree from an accredited institution, or completed a Direct Transfer Agreement (DTA) associate degree.

To facilitate access for transfer students, program planners have met with faculty of Green River Community College, Yakima Valley Community College, Wenatchee Community College, and Big Bend Community College to articulate course alignment. CWU participates in Major Related Program (MRP) agreements pertinent to the MLMST in elementary education, mathematics education, and secondary science education. In each MRP, students must be carefully advised to maximize progress toward the MLMST degree. CWU plans to encourage transfer students to take advantage of these MRPs and work with community college advisors to ensure that students complete the most appropriate MRP for their goals.

After admission, students would earn 47-52 credits within the Professional Education Program (PEP) in addition to 74 credits within the MLMST major. The PEP includes coursework in human development, educational psychology, teaching methods, reading in the content fields, and instructional technology as well as an internship. MLMST coursework would include 11 credits of education courses, 27 credits (including 23 lower-division) of mathematics courses, 33 credits (including 25 lower-division) of science courses, and a 3-credit integrated course on math and science teaching.

Courses would be taught primarily by full-time, tenured/tenure-track faculty. All of the courses have already been developed, and students would typically take a combination of PEP and MLMST courses, depending on the quarter. Since a number of the math and science content courses are lower-division courses that also count towards CWU’s general education requirements, students should be able to graduate about two years after entering the TPP.

Students would demonstrate the ability to:

- Practice habits of mathematical thinking including problem solving, reasoning, communicating mathematically, making connections, and using multiple representations;
- Investigate and analyze problems through scientific inquiry and critical thinking;
- Describe and apply concepts and skills of mathematics (number and operation; algebra; geometry; data analysis, statistics, and probability; measurement, calculus, discrete mathematics) and science (life science, physical science, earth and space science);
- Properly integrate technology to conduct student-centered scientific inquiry and mathematical problem solving with proper safety precautions observed at all times;

- Create a learning environment for middle-level science and mathematics students that applies developmentally appropriate and culturally responsive curriculum and assessments;
- Incorporate current events into the classroom to pique student interest in mathematics and science and to actively engage students as proactive, contributing citizens within their community.

To achieve these learning outcomes, student work would be aligned with state competencies. Students would meet state requirements by achieving specific, performance-based learning outcomes directly linked to state certification and endorsement requirements.

Students would be assessed through problem sets, exams, reflective writing, and observations of their teaching. In addition, all students would demonstrate knowledge, skill, and dispositional proficiencies through a program portfolio prior to student teaching. Finally, students who complete the major would be required to attain a passing score on the Washington Educator Skills Test-Endorsements (WEST-E) for middle-level mathematics and middle-level science to be eligible to receive endorsements.

To assess the program's performance, CWU plans to use:

- Entry surveys to assess student expectations and goals;
- Biennial course assessments to measure student learning and how well the course is meeting student needs and program goals;
- Assessments of the quality of student program portfolios;
- West-E exam scores;
- Surveys, focus groups, or interviews of graduates upon graduation as well as a year after completion of the program;
- Surveys, focus groups, or interviews of principals;
- Periodic surveys of and consultations with school district professionals, professional associations, educational service districts, and state agencies (particularly regarding the content of the program as it relates to professional educator and student learning standards).

Results would be used to develop and implement changes in coursework and teaching approaches.

Program Costs

The MLMST major would enroll 10 FTE students the first year, growing to full enrollment of 30 FTE students by its fifth year. It would be supported by state funding and tuition and would not require any new courses, faculty, or funding to launch. At full enrollment, the program would require 2.39 FTE faculty for instruction and 0.39 FTE faculty and staff for administration (including 0.07 FTE each for faculty co-directors). At full enrollment, the direct cost of instruction would be \$213,841, or \$7,128 per FTE student.

In comparison, the HECB's 2005-06 *Education Cost Study* (July 2007) reports that the direct cost of instruction per average annual upper-division FTE Arts and Letters⁹ undergraduate student was \$6,149 at CWU and ranged from \$4,725 at The Evergreen State College to \$7,278 at University of Washington Seattle. The MLMST cost lies within this range.

External Review

Three reviewers evaluated the proposal: Dr. Keith Adolphson, Associate Professor of Mathematics Education, Eastern Washington University; Dr. David Buhl, Professor, Mathematics and Computer Science Department, Northern Michigan University; and Mr. Rodger Hauge, Senior Lecturer, Department of Education, Eastern Washington University. The first two reviewers are mathematics or math education faculty, and the third is science education faculty. All three reviewers were supportive of the proposed program, with two recommending approval and one limiting his comments to the mathematics coursework, of which he spoke positively.

Dr. Buhl limited his focus to the mathematics courses. They "provide a nice blend of in-depth investigation into key mathematics topics along with an appropriate survey of key mathematics topics," he said. Dr. Adolphson found the proposed major and its courses "adequately addressed the required competencies for the Middle Level Mathematics and Middle Level Science endorsements." He recommended approval of the program, stating it would "strengthen the existing mathematics education program at Central Washington University while providing needed endorsements focused on middle level teaching." Mr. Hauge also recommended approval of the program, stating that "the proposed major will do an outstanding job of preparing candidates for this challenging profession."

Only Mr. Hauge made any suggestions, and program planners responded to them sufficiently. For example, to address concerns about the clarity of course learning outcomes, program planners said they would work with science and mathematics faculty to phrase them in an accessible way.

Public Comment

During the public comment period, the HECB received an email from Dr. Michelle Andreas, Associate Director of Education Services, State Board for Technical and Community Colleges, indicating that some community college faculty were concerned that the science courses listed (or at least their equivalents in the community college system) would not adequately prepare students for the science endorsement competencies. The faculty suggested including a year-long science sequence and more rigorous chemistry and biology courses.

Program planners responded by explaining that an appendix in the proposal demonstrated alignment between the endorsement competencies and the topics taught in the science courses. In addition, Mr. Hauge noted that national, discipline, and state standards have been incorporated into the program, especially in the upper-division homework.

⁹ The category Arts and Letters is used for cost comparison rather than Education because the proposed budget did not cover the professional preparation component of the degree (the PEP).

Staff Analysis

The proposed program would be the first of its kind in the region. It would support CWU's mission and the *Strategic Master Plan for Higher Education* by developing the capacity of teachers to teach students in mathematics and science. CWU would employ multiple strategies to enhance the diversity within the program.

Program planners submitted sufficient evidence the proposed major would respond to employer, student, and community need without duplicating other programs. It would respond to employer need by providing the coursework necessary for endorsements in mathematics and science, two high-need subject matter areas in Washington and the nation. It would respond to student need by providing an efficient way for students to obtain those endorsements. Finally, it would respond to community need by supporting Washington Learns and strengthening teacher preparation in math and science, fields crucial to the state's future economic prosperity.

Students would be taught primarily by full-time, tenured/tenure-track faculty. They would study a program supported by external reviewers and would be assessed using multiple measures. Program assessment also would employ multiple measures.

Education programs at CWU are accredited by the National Council for Accreditation of Teacher Education (NCATE), which granted its most recent continuing accreditation approval in 2005. Not every education program in Washington is accredited by NCATE.

The program would be launched without any new hires, and it would not require any new course development. It would be funded through internal reallocation and offered at a reasonable cost.

Staff Recommendation

After careful review of the proposal and supporting materials, staff recommends approval of the Bachelor of Arts in Middle Level Mathematics and Science Teaching at Central Washington University. The Higher Education Coordinating Board's Education Committee discussed the proposal during its February 16, 2010 meeting and recommended approval by the full Board.

RESOLUTION NO. 10-04

WHEREAS, Central Washington University proposes to offer a Bachelor of Arts in Middle Level Mathematics and Science Teaching; and

WHEREAS, The program would support the university's mission, as well as the *Strategic Master Plan for Higher Education*; and

WHEREAS, The program would respond to student, employer, and community need without duplicating existing programs; and

WHEREAS, The program's students would study a curriculum that would meet the academic requirements for endorsements in Middle Level Mathematics and Middle Level Science; and

WHEREAS, The program has support from external reviewers; and

WHEREAS, The program would be offered at a reasonable cost;

THEREFORE, BE IT RESOLVED, That the Higher Education Coordinating Board approves the Bachelor of Arts in Middle Level Mathematics and Science Teaching at Central Washington University effective March 10, 2010.

Adopted:

March 10, 2010

Attest:

Jesús Hernandez, Chair

Earl Hale, Vice Chair